WHAT IS CLAIMED IS:

1. A solid-state imaging device comprising a plurality of vertical charge transferring portions, and a horizontal charge transferring portion that is connected to at least one end of the vertical charge transferring portion, receives charges transferred from the vertical charge transferring portions and transfer the charges,

wherein the vertical charge transferring portion includes a vertical transfer channel region of a first conductivity, an element separating region of a second conductivity formed so as to be adjacent to the vertical transfer channel region of the first conductivity, a plurality of vertical transfer electrodes and a final vertical transfer electrode formed on the vertical transfer channel region of the first conductivity, and a vertical well region of the second conductivity formed below the vertical transfer channel region of the first conductivity,

the horizontal charge transferring portion includes a horizontal transfer channel region of a first conductivity, and a plurality of horizontal transfer electrodes formed on the vertical transfer channel region of the first conductivity, and a horizontal well region of the second conductivity formed below the horizontal transfer channel region of the first conductivity,

in a connection portion between the vertical charge transferring portions and the horizontal charge transferring portion, the vertical transfer channel region of the first conductivity, the element separating region of the second conductivity and the vertical well region of the second conductivity extend from the vertical charge transferring portions, and a part of the horizontal transfer electrodes is overlapped on a portion of the vertical transfer channel region of the first conductivity that extends in the connection portion, and

end portions of the portions of the vertical transfer channel region of the first conductivity and the vertical well region of the second conductivity that extend in the connection portion are positioned more on the side of the horizontal charge transferring portion than an end portion of the final vertical transfer electrode on the side of the horizontal charge transferring portion, and are positioned within 1.5 μm from the end portion of the element separating region of the second conductivity on the side of the horizontal charge transferring portion.

2. The solid-state imaging device according to claim 1, wherein the horizontal transfer channel region of the first conductivity is formed so as to have a lower impurity concentration than that of the vertical transfer channel region of the first conductivity.

3. The solid-state imaging device according to claim 1, wherein the horizontal transfer channel region of the first conductivity is formed so as to have a larger diffusion depth than that of the vertical transfer channel region of the first conductivity.

4. The solid-state imaging device according to claim 1, wherein the horizontal well region of the second conductivity is formed so as to have a lower impurity concentration than that of the vertical well region of the second conductivity.

5. The solid-state imaging device according to claim 1, wherein the horizontal well region of the second conductivity is formed so as to have a larger diffusion depth than that of the vertical well region of the second conductivity.

6. The solid-state imaging device according to claim 1, wherein the impurity concentrations of the vertical transfer channel region of the first conductivity and the horizontal transfer channel region of the first conductivity are set such that, with respect to the horizontal transfer electrodes arranged so as to overlap the vertical transfer channel region of the first conductivity in the connection portion, a channel potential of the horizontal transfer channel region of the first conductivity positioned below the horizontal transfer electrodes is deeper than that of the vertical transfer channel region of the first conductivity positioned below the horizontal transfer electrodes.

7. A method for producing the solid-state imaging device according to claim 1, comprising:

forming an ion implantation blocking film on a semiconductor substrate;

forming a first photoresist film on the ion implantation blocking film;

patterning the first photoresist film and the ion implantation blocking film such that the first photoresist film and the ion implantation blocking

film are left on a region to be formed into an element separating region of a second conductivity and are removed from a region to be formed into a vertical transfer channel region of a first conductivity and a horizontal transfer channel region of the first conductivity;

forming the vertical transfer channel region of the first conductivity and the horizontal transfer channel region of the first conductivity by implanting ions of impurities of the first conductivity in a surface layer of the semiconductor substrate, and forming a vertical well region of the first conductivity and a horizontal well region of the first conductivity by implanting ions of impurities of the second conductivity below the vertical transfer channel region of the first conductivity and the horizontal transfer channel region of the first conductivity, using the first photoresist film and the ion implantation blocking film as a mask;

removing the first photoresist film and then forming a second photoresist film on the semiconductor substrate;

patterning the second photoresist film such that the second photoresist is left on the horizontal transfer channel region of the first conductivity and removed from the vertical transfer channel region of the first conductivity; and

implanting further ions of impurities of the first conductivity in the vertical transfer channel region of the first conductivity, using the second photoresist film and the ion implantation blocking film as a mask.

8. A method for producing the solid-state imaging device according to claim 1, comprising:

forming an ion implantation blocking film on a semiconductor substrate;

forming a first photoresist film on the ion implantation blocking film;

patterning the first photoresist film and the ion implantation blocking film such that the first photoresist film and the ion implantation blocking film are left on a region to be formed into an element separating region of a second conductivity and are removed from a region to be formed into a vertical transfer channel region of a first conductivity and a horizontal transfer channel region of the first conductivity;

forming the vertical transfer channel region of the first conductivity and the horizontal transfer channel region of the first conductivity by implanting ions of impurities of the first conductivity in a surface layer of the

semiconductor substrate using the first photoresist film and the ion implantation blocking film as a mask,

removing the first photoresist film and then forming a second photoresist film on the semiconductor substrate;

patterning the second photoresist film such that the second photoresist is left on the horizontal transfer channel region of the first conductivity and removed from at least on the vertical transfer channel region of the first conductivity;

forming a vertical well region of the second conductivity by implanting further ions of impurities of the first conductivity in the vertical transfer channel region and implanting ions of impurities of the second conductivity below the vertical transfer channel region, using the second photoresist film and the ion implantation blocking film as a mask;

removing the second photoresist film and the ion implantation blocking film and then forming a third photoresist film on the semiconductor substrate;

patterning the third photoresist film such that the third photoresist film is left at least on the vertical transfer channel region of the first conductivity and removed from the horizontal transfer channel region of the first conductivity; and

forming a vertical well region of the second conductivity by implanting ions of impurities of the second conductivity below the horizontal transfer channel region, using the third photoresist film as a mask.

9. A method for producing the solid-state imaging device according to claim 1, comprising:

forming a first photoresist film on a semiconductor substrate;

patterning the first photoresist film such that the first photoresist film is left on a region to be formed into an element separating region of a second conductivity and is removed from a region to be formed into a vertical transfer channel region of a first conductivity and a horizontal transfer channel region of the first conductivity;

forming the vertical transfer channel region of the first conductivity and the horizontal transfer channel region of the first conductivity by implanting ions of impurities of the first conductivity in a surface layer of the semiconductor substrate using the first photoresist film as a mask, and forming a vertical well region of the first conductivity and a horizontal well

region of the first conductivity by implanting ions of impurities of the second conductivity below the vertical transfer channel region of the first conductivity and the horizontal transfer channel region of the first conductivity;

removing the first photoresist film and then forming a second photoresist film on the semiconductor substrate;

patterning the second photoresist film such that the second photoresist is left on a region to be formed into an element separating region of the second conductivity and the horizontal transfer channel region of the first conductivity and is removed from the horizontal transfer channel region of the first conductivity; and

implanting further ions of impurities of the second conductivity in the horizontal transfer channel region of the first conductivity, using the second photoresist film as a mask.

10. The method for producing the solid-state imaging device according to claim 9, further comprising implanting ions of impurities of the first conductivity in the horizontal well region of the second conductivity, using the second photoresist film as a mask.